

REMARKS

Claims 1 and 3-21 are pending in this application. By this Amendment, claims 1 and 7 are amended, and claim 21 is added. Support for the amendments to the claims can be found, for example, in original claim 2 and page 17, lines 1-24 of the specification. No new matter is added. Claim 2 is canceled without prejudice to, or disclaimer of, the subject matter recited in that claim. Reconsideration of the application in view of the above amendments and the following remarks is respectfully requested.

As a preliminary matter, an Information Disclosure Statement is being submitted concurrently with this Amendment. Applicants respectfully request the Examiner consider the references cited in the PTO-1449 and return to Applicants' undersigned representatives a signed copy of the PTO-1449.

The Office Action rejects claims 1-20 under 35 U.S.C. §103(a) over U.S. Patent No. 6,352,747 to Blackburn et al. (Blackburn) in view of U.S. Patent Application Publication No. 4,451,507 to Beltz et al. (Beltz). The rejection is respectfully traversed.

Claim Features

Independent claim 1 recites: (1) dripping a coating liquid in a ring shape in a vicinity of an outer circumference on a coating surface of an object to be coated, the coating surface being formed into a convex curved shape, (2) thereafter dripping the coating liquid in a spiral shape toward a geometrical center or an optical center of the object to be coated from the vicinity of the outer circumference, and (3) a rotational speed of the object to be coated at a time of dripping the coating liquid in the ring shape being set to be a smaller value than a rotational speed of the object to be coated at a time of dripping the coating liquid in the spiral shape. Independent claims 4 and 20 recite similar features as those described above with respect to independent claim 1.

The above features recited in the claims allow even a circumferential edge part of the body to be coated uniformly without leaving an uncoated area, even when the coating surface is coated thick with the coating liquid having high viscosity.

This advantage will be described hereafter, typically in a case that the body to be coated is a lens. Namely, when the surface of the lens (coating surface) is coated with the coating liquid, conventionally, a dispenser for dripping the coating liquid is positioned immediately above the lens, and while rotating the lens in this state, the coating liquid is dripped on the coating surface from the dispenser, so that the coating liquid is diffused by a centrifugal force to thereby coat the coating surface with the coating liquid (see page 1, lines 9 to 18 of the present specification).

However, with this conventional structure, the inventors of the present application found that there is a problem (problem 1), where when the coating surface needs to be coated thick with the coating liquid having high viscosity like the coating liquid having a photochromic function, the coating surface can not be uniformly coated with the coating liquid without leaving an uncoated area (see page 2, lines 4 to 9).

In order to solve the above problem 1, the inventors of the present application attempted to drip the coating liquid on the coating surface in a spiral shape. However, the inventors found that with coating surface being formed into a convex curved shape, even using a spiral coating method there is a problem (problem 2) that, although uniformity of the coating and the leaving of the uncoated area are improved in the central part of the coating surface, they are not improved so much in a circumferential edge part of the coating surface.

Therefore, the inventors of the present application attempted to drip the coating liquid in the ring shape in the vicinity of the outer circumference. In this manner, the uniformity of the coating and the leaving of the uncoated area are improved, even in the circumferential edge part of the coating surface. However, even with this method there was room for further

improvement in this regard. Therefore, a solution was pursued by the inventors of the present application. As a result, it was found that in the circumferential edge part of the coating surface, there is a case that dripped coating liquid drops from the lens before the dripped coating liquid is diffused by the centrifugal force. This appears to be due to the fact when the coating liquid is dripped on the coating surface of the lens, an inertial force (F1) in an opposite direction to a direction of a velocity vector at a dripping point is added to the coating liquid. The magnitude of this inertial force (F1) is proportional to a relative speed of the dispenser and the lens.

Accordingly, when the relative speed is great, the inertial force (F1) is also great. Thus, the coating liquid flies from the coating surface or slides along the coating surface before being diffused by the centrifugal force. As a result, there is a case that the coating liquid drops from the lens before being diffused by the centrifugal force.

Particularly, when the lens is disposed with its convex surface faced upward, the coating surface (convex surface) is inclined downward toward the outer circumference. Thus, a gravitational component parallel to the coating surface (called a resolving force (F2) hereafter) is added to the coating liquid dripped on the coating surface. Thus, a resultant force (F3) of the inertial force (F1) and the resolving force (F2) is added to the coating liquid dripped on the coating surface. Accordingly, in this case, the coating liquid drops from the lens even more readily.

Such a phenomenon does not occur very much in the central part of the lens. This is because the central part of the lens is far from the outer circumference of the lens. Meanwhile, such a phenomenon occurs easily in the circumferential edge part of the lens, because this part is close to the outer circumference of the lens.

Further, when the viscosity of the coating liquid is low, this phenomenon does not occur as much. This is because when the viscosity of the coating liquid is low, there is a high

possibility that the coating liquid is diffused by the centrifugal force at a time point when it is dripped.

Therefore, the inventors of the present application attempted to solve the following problem (problem 3), where when the convex surface of the lens is coated thick with the coating liquid having high viscosity, dropping of the coating liquid from the lens is not restrained before the coating liquid is diffused by the centrifugal force.

As a result, the inventors of the present application achieved a structure that the rotational speed of the lens at the time of dripping the coating liquid in the ring shape is set to be smaller than the rotational speed of the lens at the time of dripping the coating liquid in the spiral shape. According to this structure, the inertial force (F1) can be made small. Thus, dropping of the coating liquid from the lens by the resultant force (F3) can be restrained before the coating liquid is diffused by the centrifugal force.

As a result, the coating surface can be more uniformly coated with the coating liquid, and the leaving of the uncoated part is reduced at the circumferential edge part of the dripping surface.

Applied References

Blackburn discloses a technique of dripping the coating liquid in the spiral shape, when a substrate, etc., is coated with the coating liquid. However, Blackburn does not disclose the technique of dripping the coating liquid in the ring shape in the vicinity of the outer circumference of the substrate. The Office Action acknowledges this on page 3, lines 10 to 11 of the Office Action. Thus, Blackburn does not disclose the technique of the claimed combination of dripping the coating liquid in the ring shape and dripping the coating liquid in the spiral shape.

Thus, Blackburn does not disclose the technique of setting the rotational speed of the lens at the time of dripping the coating liquid in the ring shape to be smaller than the rotational speed of the lens at the time of dripping the coating liquid in the spiral shape.

In addition, Blackburn neither discloses nor suggests the case that the coating liquid having high viscosity is dripped in the spiral shape on the lens. Thus, Blackburn neither discloses nor suggests the problems 2 and 3 discussed above, which were found by the inventors of the present application. Further, the structure described in Blackburn does not achieve the benefits of the claim features as discussed above.

With respect to the Beltz reference, Beltz discloses a technique of dripping a coating liquid in a spiral shape when the coating liquid is dripped on a surface of a semiconductor wafer. Beltz further discloses a technique of continuously varying the rotational speed of the semiconductor wafer in accordance with a distance (R) from the center of the semiconductor wafer. However, Beltz does not describe the technique of dripping the coating liquid in the ring shape in the vicinity of the outer circumference of the wafer. Accordingly, Beltz also does not described the technique of a combination of dripping the coating liquid in the ring shape and dripping the coating liquid in the spiral shape. Thus, Beltz further does not disclose the technique of setting the rotational speed of the wafer at the time of dripping the coating liquid in the ring shape to be smaller than the rotational speed of the wafer at the time of dripping the coating liquid in the spiral shape..

Additionally, Beltz neither discloses nor suggests the case that the coating liquid having high viscosity is dripped in the spiral shape. Thus, Beltz neither discloses nor suggests the problems 2 and 3 discussed above, which were found by the inventors of the present application. Further, the structure described in Beltz does not achieve the benefits of the claim features as discussed above.

The Office Action acknowledges that both Blackburn and Beltz are directed only to spiral coating methods. However, the Office Action asserts that "it would have been obvious to a design engineer having ordinary skill in the art to have started the spiral shape by first coating around the entire periphery of the substrate, thus forming a ring shape around the periphery, because otherwise part of the periphery would be left uncoated, which is undesirable in this uniform coating method." Applicants respectfully disagree.

The alleged motivation for why one of ordinary skill in the art would have modified the applied references is derived only from the present specification using impermissible hindsight reasoning. The combination of features recited in the claims was achieved for the first time by strenuous efforts of the inventors of the present application. Neither Blackburn nor Beltz recognize or are concerned with the problems 2 and 3 discussed above.

Further, even if Blackburn disclosed the claimed combination of ring and spiral coating (or if it would have been obvious as suggested by the Examiner), the object of the Beltz references is to "maintain the constant spiral beat volume." Accordingly, the object of controlling the rotational speed of the body to be coated is different between the claim features and the technique of Beltz.

For example, in the case shown in Fig. 3 of the present application, a drip part 25 in the ring shape and a drip part 26 in the spiral shape are continuous. When the technique of Beltz is applied to this structure, the same rotational speed is set in a case that a dispenser 12 is positioned at the drip part 25 in the ring shape and in a case that the dispenser 12 is positioned at a starting point of the drip part 26 in the spiral shape. This structure is different from the claim features. Thus, the structure of the present invention can not be obtained even if Blackburn and Beltz are combined.

Accordingly, in view of the above, the combination of Blackburn and Beltz would not have rendered obvious the claimed combination of features as recited in independent claims

1, 4 and 20. Claims 3 and 5-19 depend from independent claims 1, 4 and 20, and are, therefore, also patentable over Blackburn and Beltz at least for the dependence, as well as for the additional features these claims recite.

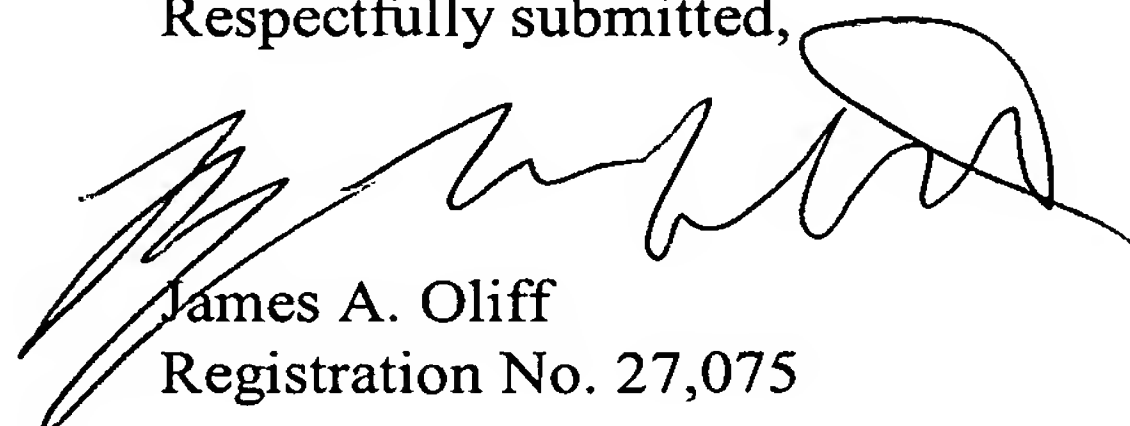
Accordingly, withdrawal of the rejection is respectfully requested.

Added claim 21 depends from independent claim 1 and is, therefore, also patentable over Blackburn and Beltz at least for the dependence, as well as for the additional features claim 21 recites.

In view of the foregoing, it is respectfully submitted that this application is in condition for allowance. Favorable reconsideration and prompt allowance are earnestly solicited.

Should the Examiner believe that anything further would be desirable in order to place this application in even better condition for allowance, the Examiner is invited to contact the undersigned at the telephone number set forth below.

Respectfully submitted,



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JAO:RMC/hs

Attachment:
Petition for Extension of Time

Date: June 22, 2011

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